ABSTRACT

Disclosed herein is a direct pool cooling type passive safety grade decay heat removal method and system for removing core decay heat in a pool type liquid metal reactor when a normal heat removal system breaks down. In the liquid metal reactor comprising a reactor vessel, the interior of which is partitioned into a hot pool above a core and a cold pool around the core so that liquid level difference between the hot pool and the cold pool is maintained by a primary pumping head under normal steady-state conditions, is disposed at least one circular vertical tube in such a manner that the sodium in the circular vertical tube is maintained with the same liquid level as the liquid level of the sodium in the cold pool. In the circular vertical tube is disposed a sodium-sodium heat exchanger, which is connected to a sodium-air heat exchanger mounted above a reactor building via a heat removing sodium loop, in such a manner that it is placed at the position higher than a liquid level of the sodium in the cold pool under the normal steady-state conditions. Under transient conditions, for example, when the normal heat removal system breaks down, the primary pump is automatically tripped, and accordingly the liquid level of the cold pool rises with the result that the liquid level difference between the hot pool and the cold pool is eliminated. Consequently, the sodium-sodium heat exchanger

makes direct contact with the hot sodium so that core decay heat is discharged into a final heat sink, for example, the atmosphere. In this way, the decay heat removal system of the present invention is operated on the basis of a completely passive concept with improved operational reliability. Heat loss incurred by the decay heat removal system is minimized under normal steady-state conditions, whereby economical efficiency is maximized. The decay heat removal system of the present invention can effectively remove core decay heat under transient conditions. Moreover, the decay heat removal system of the present invention provides an additional heat removal capacity obtained by the passive vessel cooling system, whereby the decay heat removal system of the present invention can be easily applied to a large thermal rated liquid metal reactor.